

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: MASAO YAMAMOTO Serial No.: 10/567,847 Filed: FEBRUARY 10, 2006 CAMERA, METHOD, AND PROGRAM FOR ENHANCED IMAGING USING CHROMATIC ABERRATION (AS AMENDED)	Art Unit: 2851 Examiner: LIU, MICHAEL
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AMENDMENT AFTER FINAL REJECTION

Mail Stop: AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Final Office Action mailed on May 8, 2008, please amend the above-identified application as set forth below.

No extension of time or other fees are believed to be due, except as detailed in the attached documents. However, any extension of time necessary to prevent abandonment is hereby requested, and any fee necessary for consideration of this response is hereby authorized to be charged to Deposit Account Number 50-2613.

Amendments to the Specification: begin on page 2 of this paper.

Amendments to the Claims: reflected in the list that begins on page 5 of this paper.

Remarks: begin on page 13 of this paper.

Amendments to the Specification:

Please replace the paragraphs [0027], [0043], [0047], [0084] and [0118] of the present published patent application as shown below.

Paragraph [0027]:

The image processing means in the former case may be adapted to generate said image data with which said plurality of images generated by the same kind of said elements can be produced as separated images on the predetermined display. This allows production of the images of a subject located at different depths individually on the display. The image processing means in this case may be adapted to generate said image data with which all of said plurality of images generated by the same kind of said elements can be produced at the same time on the predetermined display. Alternatively, it may be adapted to generate said image data with which either of said plurality of images generated by the same kind of said elements can be selectively produced on the predetermined display. In these this case, a viewer who looks at the image reproduces a three dimensional image in the mind.

Paragraph [0043]:

This method comprises below below steps carried out by computer; a step of receiving said signal; a step of generating, according to received said signal, image data with which the same number of a plurality of images produced by the same kind of said elements can be produced on said display as the number of said elements; and a step of sending, to the outside, generated said image data to said display means.

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Paragraph [0047]:

Said [a] plurality of subject surface segments in the present invention may be separated from their adjacent subject surface segment at a generally equal distance. With such subject surface segments, the plurality of images obtained by the different kinds of elements provide images at different depths separated from each other at a generally equal distance. A viewer who looks at the resulting image can grasp the thickness of the subject more easily.

Paragraph [0084]:

How the camera 100 is used is described below.

Paragraph [0118]:

Under such a circumstance, the images represented by R, G, and B are also to be displayed in red, green, and blue, respectively, and it is easy to do so. However, all of them may be displayed in colors of the same hue. Alternatively, they may be displayed in achromatic color. That will give the user a better view of the image. In these cases, the circuit board 137 generates such image data. The choice of the color may be allowed to be done by using the control knob 138.

Please amend the Abstract as indicated below:

~~To provide a~~ A camera that is able to capture images of moving subjects as video images, that has a large depth of field and is thus able to capture images of thick objects, and that is able to capture images of living cells and tissues as well as tissues in water. ~~An~~ One example

includes an image pickup element 134 and an objective lens 133 disposed between the image pickup element 134 and a subject. A photosensitive surface 134A of the image pickup element 134 has elements sensitive to the lights light in the red, green, and blue spectral regions, respectively. In this camera, using Using chromatic aberration of the objective lens 133, the element that is sensitive to the light in the red spectral region receives the light in a red spectral region LR from a subject surface segment XR, the element that is sensitive to the light in the green spectral region receives the light in a green spectral region LG from a subject surface segment XG, and the element that is sensitive to the light in the blue spectral region receives the light in a blue spectral region LB from a subject surface segment XB, to form an image, the respective elements sensitive to light from the red, green and blue spectral region, collect light from respective surface segments XR, XG, and XB that lie at different heights in the subject.

The images taken by the respective elements are imaged individually and produced on a monitor.

Amendments to the Claims

This listing of claims replaces all prior versions, and listings, of claims in this application.

Listing of Claims:

1-7. (Canceled)

8. (Currently Amended) A camera comprising: an objective lens where an imaging light enters; image pickup means having a photosensitive surface that receives the imaging light directed after being passed through said objective lens to form an image, the photosensitive surface having different kinds of elements arranged in an array that are for generating predetermined signals in response to imaging light in different wavelengths; and image processing means for generating image data that are used to produce, on a predetermined display, an image taken by said image pickup means according to received said signal to send them to the outside, said objective lens being adapted to receive imaging lights from each of a plurality of subject surface segments located at different depths from said photosensitive surface and form an image on said photosensitive surface using chromatic aberration, while said photosensitive surface is positioned at a fixed distance with respect to a sample that produces the imaging light stationary, each of the imaging lights having a wavelength identical to one of said different wavelengths and being different from each other, said image processing means being adapted to generate, according to said predetermined signals generated by said different kinds of elements, said image data with which achromatic images can be produced on the a-predetermined display.

9. (Currently Amended) A camera comprising: an objective lens where an imaging light enters; and image pickup means that receives the imaging light directed after being passed through said objective lens to form an image, the image pickup means having a photosensitive surface, the photosensitive surface having different kinds of elements arranged in an array that are for generating predetermined signals in response to imaging light in different wavelengths, said objective lens being adapted to receive imaging lights from each of a plurality of subject surface segments located at different depths from said photosensitive surface and form an image on said photosensitive surface using chromatic aberration, each of the imaging lights having a wavelength identical to one of said different wavelengths and being different from each other, wherein said plurality of subject surface segments are separated from their adjacent subject surface segment at a generally equal distance.

10. (Currently Amended) A camera comprising: an objective lens where an imaging light enters; and image pickup means that receives the imaging light directed after being passed through said objective lens to form an image, the image pickup means having a photosensitive surface, the photosensitive surface having different kinds of elements arranged in an array that are for generating predetermined signals in response to imaging light in different wavelengths, said objective lens being adapted to receive imaging lights from each of a plurality of subject surface segments located at different depths from said photosensitive surface and form an image on said photosensitive surface using chromatic aberration, each of the imaging lights having a wavelength identical to one of said different wavelengths and being different from each other, wherein each subject surface segment of said plurality of subject surface segments are is

separated from their an adjacent subject surface segment at a distance not larger than the depth of field of said objective lens.

11. (Currently Amended) A camera comprising: an objective lens where an imaging light enters; and image pickup means that receives the imaging light directed after being passed through said objective lens to form an image, the image pickup means having a photosensitive surface, the photosensitive surface having different kinds of elements arranged in an array that are for generating predetermined signals in response to imaging light in different wavelengths, said objective lens being adapted to receive imaging lights from each of a plurality of subject surface segments located at different depths from said photosensitive surface and form an image on said photosensitive surface using chromatic aberration, each of the imaging lights having a wavelength identical to one of said different wavelengths and being different from each other, wherein said different kinds of elements are the following three kinds of elements: the element that is sensitive to the light in the red spectral region, the element that is sensitive to the light in the green spectral region, and the element that is sensitive to the light in the blue spectral region, said plurality of subject surface segments are three kinds of subject surface segments in which each of the light in the red spectral region therefrom, the light in the green spectral region therefrom, and the light in the blue spectral region therefrom is focused through said objective lens to form from an image on said photosensitive surface.

12. (Currently Amended) An image processor that is used in combination with a camera, the camera comprising: an objective lens where an imaging light enters; image pickup means having

a photosensitive surface that receives the imaging light directed after being passed through said objective lens to form an image, the photosensitive surface having different kinds of elements arranged in an array that are for generating predetermined signals in response to imaging light in different wavelengths; and output means that sends, to the outside, received said predetermined signals signal, said objective lens being adapted to receive imaging lights from each of a plurality of subject surface segments located at different depths from said photosensitive surface and form an image on said photosensitive surface using chromatic aberration, while said photosensitive surface is positioned at a fixed distance with respect to a sample that produces the imaging light stationary, each of the imaging lights having a wavelength identical to one of said different wavelengths and being different from each other, the image processor being adapted to provide the control to produce, on a predetermined display, an image according to said signal received from said output means,

the image processor comprising: means for receiving said predetermined signals signal; processing means for generating, according to received said predetermined signals signal, image data with which a plurality of images comprising a respective image corresponding to signals received from only one kind of element of each different kind of elements can be produced the same number of a plurality of images produced by the same kind of said elements can be produced on said display as the number of said elements; and means for sending, to the outside, generated said image data to said display means, wherein said processing means is adapted to generate, according to said signal generated by said different kinds of elements, said image data with which achromatic images can be produced on said display.

13. (Currently Amended) The image processor as claimed in Claim 12, wherein said processing means is adapted to generate said image data with which said plurality of images ~~generated by the same kind of said elements~~ can be produced as separate images on said display.

14. (Currently Amended) The image processor as claimed Claim 12, wherein said processing means is adapted to allow simultaneous production of all of said plurality of images ~~generated by the same kind of said elements~~ on said display.

15. (Currently Amended) The image processor as claimed in Claim 12, wherein said processing means is adapted to allow selective production of any of said plurality of images ~~generated by the same kind of said elements~~.

16. (Currently Amended) The image processor as claimed in Claim 12, wherein said processing means is adapted to allow production of an image on said display, the image being generated by overlapping said plurality of images ~~generated by the same kind of said elements~~.

17. (Currently Amended) The image processor as claimed in Claim 12, wherein said processing means is adapted to allow production of an image on said display, the image being generated by converting said plurality of images ~~generated by the same kind of said elements~~ and then overlapping the plurality of images them.

18. (Original) The image processor as claimed in Claim 12, wherein said processing means is adapted to generate, according to said predetermined signals signal generated by said different kinds of elements, said image data with which images in colors of only the same hue can be produced on said display.

19. (Canceled)

20. (Currently Amended) An image data processing method to be carried out in an image processor having a computer, the image processor being used in combination with a camera, the camera comprising: an objective lens where an imaging light enters; image pickup means having a photosensitive surface that receives the imaging light directed after being passed through said objective lens to form an image, the photosensitive surface having different kinds elements arranged in an array that are for generating predetermined signals in response to imaging light in different wavelengths; and output means that sends, to the outside, received said predetermined signals signal, said objective lens being adapted to receive imaging lights from each of a plurality of subject surface segments located at different depths from said photosensitive surface and form an image on said photosensitive surface using chromatic aberration, while said photosensitive surface is positioned at a fixed distance with respect to a sample that produces the imaging light stationary, each of the imaging lights having a wavelength identical to one of said different wavelengths and being different from each other, the image processor being adapted to provide the control to produce, on a predetermined display, an image according to said predetermined

signals signal received from said output means, said image data processing method comprising below steps carried out by said computer comprising:

a step of receiving said predetermined signals signal;

a step of generating, according to received said predetermined signals signal, image data with which a plurality of images comprising a respective image corresponding to signals received from only one kind of element of each different kind of elements can be produced the same number of a plurality of images produced by the same kind of said elements can be produced on said display as the number of said elements; and

a step of sending, to the outside, generated said image data to said display means, wherein said image processor generates, according to said signal generated by said different kinds of elements, said image data with which achromatic images can be produced on said display.

21. (Currently Amended) A computer-readable program used in combination with an image processor having a computer, the image processor being used in combination with a camera, the camera comprising: an objective lens where an imaging light enters; image pickup means having a photosensitive surface that receives the imaging light directed after being passed through said objective lens to form an image, the photosensitive surface having different kinds of elements arranged in an array that are for generating predetermined signals in response to imaging light in different wavelengths; and output means that sends, to the outside, received said predetermined signals signal, said objective lens being adapted to receive imaging lights from each of a plurality of subject surface segments located at different depths from said

photosensitive surface and form an image on said photosensitive surface using chromatic aberration, while said photosensitive surface is positioned at a fixed distance with respect to a sample that produces the imaging light stationary, each of the imaging lights having wavelength identical to one of said different wavelengths and being different from each other, the image processor being adapted to provide the control to produce, on a predetermined display, an image according to said signal received from said output means, the computer-readable program being for carrying out, by said computer, at least:

a processing of receiving said predetermined signals signal;

a processing of generating, according to received said predetermined signals signal, image data with which a plurality of images comprising a respective image corresponding to signals received from only one kind of element of each different kind of elements can be produced the same number of a plurality of images produced by the same kind of said elements can be produced on said display as the number of said elements; and

a processing of sending, to the outside, generated said image data to said display means wherein said image processor generates, according to said signal generated by said different kinds of elements, said image data with which achromatic images can be produced on said display.

22. (Canceled)

REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendment and the following remarks.

Claims 2-22 were pending in this application. In this Amendment, claims 2-7, 19, and 22 have been canceled. Claims 8-18 and 20-21 have been amended. No new subject matter has been added. Accordingly, claims 8-18 and 20-21 will be pending upon entry of this Amendment.

In the Office Action mailed May 8, 2008, the Examiner objected to the abstract (for containing two paragraphs and exceeding 150 words), the specification (published patent application paragraphs [0027], [0043], [0047], [0084] and [0118] for various minor informalities), and the claims (for various informalities). Under 35 U.S.C. § 112, first paragraph, the Examiner rejected claims 2, 7-12, and 20-22 as failing to comply with the written description requirement. Under 35 U.S.C. § 103(a), the Examiner rejected claims 2-7, 12-18, and 20-22 as being unpatentable over U.S. Patent Application Publication No. 2003/0095328 to Boehm et al. in view of U.S. Patent No. 6,917,421 to Wihl et al.

The Examiner also allowed claims 8-11 and indicated that claim 19 would be allowable if rewritten in independent form to include all the limitations of its base claim and any intervening claims. Applicant acknowledges with thanks this indication of allowed claims and allowable subject matter. Consistent with the Examiner's indication, and to advance prosecution of this application, Applicant has canceled rejected claims without prejudice to or disclaimer of the subject matter recited therein, and has amended claims to include the subject matter found allowable in claim 19. As set forth in detail below, Applicant has also amended the abstract,

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specification, and claims substantially as suggested by the Examiner (with a minor exception noted below), to place this application in condition for allowance.

Specification Amendments

Applicant has amended the abstract to conform to the requirements noted by the Examiner. Applicant has also amended the paragraphs of the specification noted by the Examiner, consistent with the Examiner's suggestions.

Rejections Of Claims 2-7, 12-18, And 20-22 Under 35 U.S.C. § 103(a)

To advance prosecution of this application, claims 2-7, 19, and 22 have been canceled without prejudice to or disclaimer of the subject matter contained therein. Claim 12 has been amended to include all the limitations of canceled claim 19, which was deemed to be allowable if amended in independent form to include all the limitations of claim 12. Independent claims 20-21, which recite a method and a computer readable program, respectively, have each been amended to include all the subject matter that the Examiner found in allowable in claim 19. Accordingly, remaining claim 12, and its dependent claims 12-18, as well as claims 20-21, should be patentable over the cited art.

In addition, the preamble in each of claims 12, 20, and 21 has also been amended for more clarity. For example, claim 12 has been amended from "An image processor that is used in combination with a camera comprising:" to now recite --An image processor that is used in combination with a camera, the camera comprising:--.

Rejections Of Claims 2, 7-12, And 20-22 Under 35 U.S.C. § 112, First Paragraph

The phrase "while said photosensitive surface is stationary" that was objected to as lacking support in the specification, has been replaced in the remaining independent claims 8 and

12 with the phrase “while said photosensitive surface is *positioned at a fixed distance with respect to a sample that produces the imaging light*” to clarify that the distance between the sample and imaging surface is fixed during imaging, that is, the photosensitive surface is stationary with respect to the sample. This is clearly supported in the present application by Figures 1, 2, and 6 and the corresponding discussion. For example, paragraph [0085] states in part:

In order to take an image with the camera 100, the subject S is placed on the mount 110 *at a predetermined position*. Then, the knob 132 is used to move the camera body 130 in the up-and-down direction in FIG. 1. The *camera body 130 is fixed at an appropriate position where the subject S is in focus*.

(Emphasis added.) Accordingly, Applicant respectfully submits that claims 8-12 and 20-21 comply with the written description requirement of 35 U.S.C. § 112, first paragraph.

Claim Objections

The specific claim objections in the Office Action are listed below under the sub-paragraphs set forth in the Office Action, together with a summary of Applicant's response to each specific objection.

a) Claims 2-6, 12-17, 20, and 21 were objected to as reciting the “same kind of elements,” which was deemed as not making sense. As noted, claims 2-6 have been canceled. Independent claim 12 has been amended to recite substantially the same subject matter as that objected to by the Examiner, but in a manner intended to improve the clarity. Amended claim 12 recites image data with which *a plurality of images comprising a respective image corresponding to signals received from only one kind of element of each different kind of elements can be produced* [emphasis added to show amended language], which highlights that

the image data is formed from different signals in which a plurality of images can be produced where each image corresponds to a different kind of element, as was the intention in the original claim language. Support for this can be found in the present specification at, for example, paragraph [0107], which states in part:

... image data with which the same number of images produced by the same kind of elements are provided as the number of the elements. More specifically, in this embodiment, the circuit board 137 generates image data with which the following three kinds of images can be displayed on the monitor M: the image of the subject surface segment XR taken by the element that is sensitive to the light in the red spectral region in response to the light in the red spectral region, the image of the subject surface segment XG taken by the element that is sensitive to the light in the green spectral region in response to the light in the green spectral region, and the image of the subject surface segment XB taken by the element that is sensitive to the light in the blue spectral region in response to the light in the blue spectral region.

The above paragraph illustrates that the term objected to by the Examiner (the "image data with which the same number of images produced by the same kind of elements") denotes a plurality of images in which each image corresponds to a different kind of element (color in this case) and the kinds of images (three) correspond to the number of different elements (3 colors), where each image corresponds to a different element (either red, green, or blue). Accordingly, claim 12 has been amended to more clearly recite that each *respective image* (corresponds to *signals received from only one kind of element of each different kind of elements*).

b) Claims 2, 7-12, and 20-22 were objected to as reciting "imaging lights," whereas it was suggested by the Examiner that the term "reflected lights" should be used to remove ambiguity. The Examiner recommended that the phrase "to light in different wavelengths" be amended to recite --to the imaging light in different wavelengths--.

Applicants respectfully point out that the "initial" imaging lights referred to by the Examiner and described in the specification and recited in the claims are themselves reflected lights (see the imaging light beam incident on objective lens 133 in Figure 1), so that their recitation in the current claims is correct, and does not create any ambiguity. The remaining minor informalities listed under sub-paragraph b) have been addressed as suggested by the Examiner.

- c) Claims 2 and 7 have been canceled, thereby rendering their objection moot. In claims 8, 12, and 20-21, the term "said signal" has been replaced with --said predetermined signals-- as suggested by the Examiner.
- d) Claim 2 has been canceled, thereby rendering its objection moot.
- e) Claim 7 has been canceled, thereby rendering its objection moot. The last line of claim 8 has been amended to recite "the predetermined display" as suggested by the Examiner.
- f) Claim 10 has been amended for clarity to recite that *each* subject surface segment of said plurality of subject surface segments is separated from *an* adjacent subject surface segment.
- g) Claim 11 has been amended to change the "from" to --form--.
- h) Claim 22 has been amended to delete the "the" from the phrase "a the photosensitive surface" as suggested by the Examiner.

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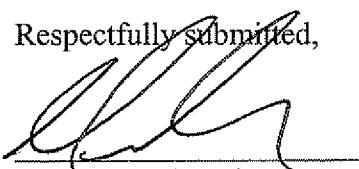
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In view of the foregoing, all of the claims in this case are believed to be in condition for allowance. Should the Examiner have any questions or determine that any further action is desirable to place this application in even better condition for issue, the Examiner is encouraged to telephone Applicant's undersigned representative at the number listed below.

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Respectfully submitted,

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